The W4AQL Satellite Station

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Abstract-- **The Georgia Tech Amateur Radio Club, W4AQL, has created a series of papers detailing the various steps taken in setting up different portions of the station. This paper deals with the setup of a satellite system for tracking and using Amateur Satellites in preparation for Phase 3D, which could go up as early as October, 1999. Though not rich in actual technical data, this paper details the thought process behind the creation of the station, what components were chosen, and why they were selected for use in the college environment.**

***Index Terms*—Amateur Radio, Oscar, Phase 3D, Satellite**

I. Introduction

Someone asked me once to do a write-up of my experience in setting up part of the club station at Georgia Tech. After a little thought, I decided I could extend those write-ups to cover a wide range of topics because I did quite a bit of setting up in my time as President of W4AQL. The first article was about establishing a 56K link into the East Atlanta LAN, which really involved only taking other people's hardware and software and integrating it. The extent of this satellite project is very similar in that regard - no new hardware or software was created to complete this project. This technical bulletin (which is not very technical) is a write-up on the challenges in setting up a satellite station in the middle of the noisy RF environment of Atlanta, GA.

II. Setup of Tracking Software and Hardware

A. Rotor Control and Az-El Rotator

The club was lucky enough to own a Yaesu G-5600B that we could use to control both the azimuth and elevation of our satellite antennas. However, that controller had been condemned to sit and serve as the azimuth controller for a rotator doing duty turning an aging TH6. We purchased a replacement antenna for the TH6 and installed it some 50 feet in the air, leaving us with a "free" rotator. Through a series of side projects the rotator became available and we were able to set about using it for satellite service, along with an elevation rotator that was sitting in our club shack (we were fortunate enough to have an elevation rotator capable of turning through 180°). Now, with rotators in place we were faced with the task of computer control. We explored a few options, including the Kansas City Tracker Board. However, we decided on the more costly Yaesu GS-232 rotor controller interface based on the fact that it was designed to work exactly with our rotator control box. After the initial setup we were able to get the computer to turn both the azimuth and elevation rotators.

B. Computer Control of Radio

After completing the first phase of getting the basic hardware to work, we turned our attention to radio control. In late 1998 the club purchased a Yaesu FT-847 transceiver that was capable of HF, VHF, and UHF. The radio also had installed TTL converters so that it was "plug and play" with a computer (connected via a null modem cable). Equally important with the radio was the fact that it had a satellite mode built in, whereby some of the basics of operation were already defined within the radio. All these aspects combined to provide an excellent choice for a club radio - at the time it provided us with a new radio capable of working a broad spectrum of frequencies and modes. The radio also had many features that could be used through future expansion. After connecting the radio to the computer we were able to use computer control to set our frequencies and adjust for Doppler Shift (actually done in the software program). Now, lacking cables and preamps, we turned our focus to the software we would use to control the setup.

C. Radio Control and Tracking Software

The first place we turned was the AMSAT web site[1]. There, we found a large listing of software for computer control of rotators and radios. Their flagship product, *Instant*Track, seemed to be the first and logical choice. We were not initially sure if this program was compatible with the 847 or our rotator controller interface so we have opted out of this program for the time being. When their next version is released, v1.5, we will again evaluate the program to see what improvements are made (Y2K is a concern due to the fact that accurate calculations need to be made based upon the date). Continuing to evaluate the software available, we decided upon FodTrack, v2.5, written by Manfred Mornhinweg, XQ2FOD. Although this software does not have any sort of graphical representation of the satellites, it is able to control our rotators via the GS-232 interface as well as our radio. Though open to further selection, the current software and hardware we are running is well tuned to the collegiate environment where ease of use is a priority given the relatively high turnover rate experienced at collegiate stations. While hardware, including radios, may last upwards of fifteen or twenty years, students are typically attending school for 1/3 of that time. Thus, whatever our setup, we needed something that would be easy use and learn.

[1] http://www.amsat.org

III. Completion of Satellite Station

Currently we do not have any satellite antennas installed on the roof, nor do we have our rotators set up for satellite operation. However, we do have a 10-ft. tripod that we will use for the satellite station that will be attached near the location we bring coax into the building. Additionally, we expect to be using cable such as LMR-400 or 9913 to feed the radio from the location on the roof. We also need to evaluate preamps for both the amateur 2-m and 70-cm bands. As far as antennas, currently we are expecting to install circularly polarized beams, with a 22-element antenna on 2-m with 12.5 dB of gain and a 42-element antenna on 70-cm with 16.8 dB of gain. Due to our advantageous location with good visibility on all sides we are not planning on installing an antenna array. One of the other factors for ruling out an array, in addition to cost and maintenance, was the prospect of utilizing another facility for EME operations. Though our satellite project is not yet complete, it is well on its way to getting there and should be complete with one weekend of work.

Appendix

Appendices, if needed, appear before the acknowledgment.

Acknowledgment

Thanks is extended to Dr. Paul Steffes, Professor of ECE, for his continued support and advisement of the students of the Georgia Tech Amateur Radio Club.

About W4AQL

The Georgia Tech Amateur Radio Club is located in the Van Leer Electrical Engineering Building, on the campus of the Georgia Institute of Technology, located in NW Atlanta, GA. We operate a 2-Meter FM repeater and a shack of various HF, VHF, and UHF equipment. Our primary purpose is to provide a means for students of Georgia Tech to operate, but we are open to faculty, staff, and students.

Revision History

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